

National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 3621 (DSI-3621)

Satellite Coral Bleaching Products

March 14, 2003

National Climatic Data Center
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1. Abstract:

The NOAA satellite-derived global 50km Coral Bleaching Monitoring products include the 50 km nighttime only Sea Surface Temperature (SST), SST anomaly, HotSpot and Degree Heating Weeks(DHWs). These products are NESDIS/OSDPD/IPD operational products designed to monitor and predict possible coral bleaching events. The HotSpot highlights regions of extreme warm water that can be harmful to coral reefs, where sea surface temperatures are at least 1 degree C above the maximum SST climatology. The DHWs is allowed to accumulate when the HotSpot is above 1 °C, and it is used to indicate the accumulated thermal stress that coral reefs experience. These satellite coral bleaching monitoring products are widely used and have been featured on national news casts, National Geographic, public television, etc., and are extremely important to NOAA outreach to the public as well as coral reef and climate scientists and marine managers.

The binary flat data file includes a header record and 12 data records. The header record is a 720 column integer (I x 2) array and contains the number of columns, number of rows, the oldest time of SST observations (month, day, year), the latest time of SST observations (month, day, year), starting Day of Year, current Day of Year, spatial resolution of grid points, minimum latitude, maximum latitude, minimum longitude, maximum longitude as shown in Table 1. The data record contains twelve integer arrays with dimensions of 720x331, which include nighttime only SST, SST anomaly, HotSpots, DHWs and the first and last Day of Year of HotSpots occur, number of observations, ages of most recent observation, reliability, physiographic descriptor and ice field. The data records are listed in the order they appear in the coral bleaching flatfile in Table 2. The binary flat data file is generated on Linux clusters and I*2 bytes are ordered Little Endian. The data file name convection follows: NPR.STHS.NL.Dyyddd. Currently, only NOAA-16 products are available.

These products are Level-4 products derived from the NESDIS 50 km nighttime only SST data. The climatology for SST anomalies, HotSpots and DHWs are derived from Multi-Channel SSTs (MCSSTs) reprocessed by the Rosenstiel School of Marine and Atmospheric Science (RSMAS) of the University of Miami(Gleeson and Strong, 1995). These data are projected with the cylinder equal-distance projection. The satellite coral bleaching products are surface products and provide a global coverage. These data are produced twice a week and available since February 2003 at NCDC.

Table 1. Data Format of the Header Record

Word #	Byte #	Description	Units	Ranges
1	1-2	Number of Columns	Integer	720
2	3-4	Number of Rows	Integer	331
3	5-6	Month of Year (the oldest time of SST observations)	Integer	1 - 12
4	7-8	Day of Month (the oldest time of SST observations)	Integer	1 - 31

Word #	Byte #	Description	Units	Ranges
5	9-10	Year (the oldest time of SST observations)	Integer	2003-
6	11-12	Month of Year (the latest time of SST observations)	Integer	1 - 12
7	13-14	Day of Month (the latest time of SST observations)	Integer	1 - 31
8	15-16	Year (the latest time of SST observations)	Integer	2003-
9	17-18	Starting Day of Year	Integer	1 - 366
10	19-20	Ending Day of Year	Integer	1 - 366
11	21-22	Spatial Resolution of Grid Points	Degree (x100)	50
12	23-24	Minimum Latitude	Degree (x100)	-8000
13	25-26	Maximum Latitude	Degree (x100)	8500
14	27-28	Minimum Longitude	Degree (x100)	-18000
15	29-30	Maximum Longitude	Degree (x100)	17975

Table 2. Data Format of Data Records

Record #	Data Type	Description	Units	Ranges
1	Integer (720x331)	Nighttime only SST	°C (x10)	-21 to 400
2	Integer (720x331)	SST anomaly	°C (x10)	-32768 to 32767*
3	Integer (720x331)	HotSpots	°C (x10)	-32768 to 32767
4	Integer (720x331)	DHWs	°C (x10)	-32768 to 32767

Record #	Data Type	Description	Units	Ranges
5	Integer (720x331)	The maximum HotSpot value during the last 12 weeks	°C (x10)	-32768 to 32767
6	Integer (720x331)	The first Day of Year that HotSpots occur during the last 12 weeks	Day	0 to 366
7	Integer (720x331)	The last Day of Year that HotSpots occur during the last 12 weeks	Day	0 to 366
8	Integer (720x331)	Age of Most Recent Observations	Integer	0 to 255
9	Integer (720x331)	Number of Observations	Hours	0 to 255
10	Integer (720x331)	Reliability	Integer	0 to 255
11	Integer (720x331)	Physiographic Descriptor	0=sea; 1=land	0 to 15
12	Integer (720x331)	Ice Field	Integer	0 to 100

* No upper/lower limits (or QC flags) currently are put on these products

2. Element Names and Definitions:

SST: Global 50 km nighttime only satellite-derived Sea surface temperatures.

MINIMUM: -21

MAXIMUM: 400

UNITS: °C

SCALING FACTOR: 10 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331. The land flag = -99, the missing flag = -999.0 and ice flag = -9999.0.

SST anomaly: 50km nighttime only sea surface temperature compared to the climatology.

MINIMUM: no lower limit

MAXIMUM: no upper limit

UNITS: °C

SCALING FACTOR: 10 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331. The land flag = -99, the missing flag = -999.0 and ice flag = -9999.0.

HotSpot: The HotSpot represents regions where SSTs are one degree greater than the maximum expected summer time temperature based on nighttime-only 50km SST climatology.

MINIMUM: no lower limit

MAXIMUM: no upper limit

UNITS: °C

SCALING FACTOR: 10 (physical values = data/scaling factor)

DOMAIN: A 2-D integer(I*2) array with dimensions of 720x331. The land flag = -99, the missing flag = -999.0 and ice flag = -9999.0.

DHWs: Accumulated HotSpot values during the last 12 weeks.

DHW's are not allowed to accumulate with our method unless the sea surface temperature is at least 1 degree C above the maximum expected summertime temperature. Degree Heating Weeks (DHWs) are the accumulation of thermal stress that coral experience over the fixed time period (12 weeks).

MINIMUM: no lower limit

MAXIMUM: no upper limit

UNITS: °C

SCALING FACTOR: 10 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331. The land flag = -99, the missing flag = -999.0 and ice flag = -9999.0.

Max HotSpots: The maximum value of HotSpots that occurs during the last 12 weeks.

MINIMUM: no lower limit

MAXIMUM: no upper limit

UNITS: °C

SCALING FACTOR: 10 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331. The missing flag = -99.0 and ice flag = -9999.0.

THE FIRST DAY OF YEAR: The first day of year that HotSpots occur during the past 12 weeks.

MINIMUM: 1

MAXIMUM: 366

UNITS: day

SCALING FACTOR: 1 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331. The zero is assigned to the area at which no HotSpots observed.

THE LAST DAY OF YEAR: The last day of year that the HotSpots occur during the past 12 weeks.

MINIMUM: 1

MAXIMUM: 366

UNITS: day

SCALING FACTOR: 1 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331. The zero is assigned to the area at which no HotSpots observed.

AGE OF MOST RECENT OBSERVATION: The age, in hours before the time of the analysis, of the most recent observations used to determined sea surface temperature for a grid box.

MINIMUM: 0

MAXIMUM: 255

UNITS:

SCALING FACTOR: 1 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331.

NUMBER OF OBSERVATIONS: The total number of current observations used in the analysis of sea surface temperature for the grid box.

MINIMUM: 0

MAXIMUM: 255

UNITS: integer

SCALING FACTOR: 1 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331.

RELIABILITY: Data quality flags that indicate uncertainties of 50 km nighttime only SST analysis. Larger values indicate higher reliability.

MINIMUM: 0

MAXIMUM: 255

UNITS: integer

SCALING FACTOR: 1 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331.

PHYSIOGRAPHIC DESCRIPTOR: The land/sea tag that indicates whether a grid intersection is a land or sea point.

MINIMUM: 0

MAXIMUM: 15

UNITS: integer

SCALING FACTOR: 1 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331.

ICE FIELD: Percent sea ice for 50 km nighttime only SST analysis.

MINIMUM: 0

MAXIMUM: 100

UNITS: integer

SCALING FACTOR: 1 (physical values = data/scaling factor)

DOMAIN: A 2-D integer (I*2) array with dimensions of 720x331.

3. **Start Date:**

20030201

4. **Stop Date:**

Ongoing

5. **Coverage:**

- a. Southernmost Latitude: 80.00S
- b. Northernmost Latitude: 85.00N
- c. Westernmost Longitude: -180.00W
- d. Easternmost Longitude: 179.75E
- e. Resolution: 0.5 degree

6. How to Order Data:

Ask NCDC's Climate Services about costs of obtaining this dataset.

Phone: 828-271-4800
Fax: 828-271-4876
E-mail: NCDC.Orders@noaa.gov

7. Archiving Data Center:

a. Name: National Climatic Data Center/NCDC
Address: Federal Building
151 Patton Ave.
Asheville, NC 28801-5001

Voice Telephone: 828-271-4800
Facsimile Telephone: 828-271-4876
Electronic Mail Address:

8. Technical Contact:

a. Name: NESDIS/OSDPD/IPD/Product System Branch
Address: FB4 Room 2322
4401 Suitland
Suitland, MD 20746-4304

Voice Telephone: 301-457-0914
Facsimile Telephone: 301-457-0918
Electronic Mail Address: Limin.Zhao@noaa.gov or
John.Sapper@noaa.gov

9. Known Uncorrected Problems:

N/A

10. Quality Statement:

Since the coral bleaching products are Level-4 products that derived from NESDIS 50 km nighttime only SST products, the quality of the products depends both on NESDIS 50km nighttime only SST and the SST climatology used. The current SST climatology is derived from Multi-Channel SSTs (MCSSTs) reprocessed by the Rosenstiel School of Marine and Atmospheric Science (RSMAS) of the University of Miami (Gleeson and Strong, 1995). Currently, no particular QC flags are assigned to the products. However, four data fields: number of observation, age of most recent observation, reliability and ice field, are included as quality reference flags for users.

Note: The products are currently not used (not reliable) in areas where latitudes are beyond ± 45 degree although the data set provide a global coverage.

Disclaimer: While every effort has been made to ensure

that these data are accurate and reliable within the limits of the current state of the art, NOAA cannot assume liability for any damages caused by any errors or omissions in the data, nor as a result of the failure of the data to function on a particular system. NOAA makes no warranty, expressed or implied, nor does the fact of distribution constitute such a warranty.

11. **Essential Companion Datasets:**

There are no companion datasets are needed.

The National Climatic Data Center maintains the documentation for all POES data. Documentation for these products may be found by going to the following location:

For TIROS-N, NOAA-6 through NOAA-14 satellites, use:

<http://www2.ncdc.noaa.gov/docs/podug/index.htm>

For NOAA-15 through NOAA-17 satellites, use:

<http://www2.ncdc.noaa.gov/docs/klm/>

12. **References:**

- a. Liu, G., W. Skirving, and A. E. Strong. 2003, Remote Sensing of Sea Surface Temperatures During the 2002 Great Barrier Reef Coral Bleaching Event. EOS, in review.
- b. Wellington, G. M., P. W. Glynn, A. E. Strong, S. A. Navarrete, E. Wieters, and D. Hubbard. 2001. Crisis on coral reefs linked to climate change. EOS, 82(1), 1.
- c. Strong, A.E., G. Liu, T. Kimura, H. Yamano, M. Tsuchiya, S. Kakuma, and R. van Woesik. 2002. Detecting and monitoring 2001 coral reef bleaching events in Ryukyu Islands, Japan using satellite bleaching HotSpot remote sensing technique. *Proc. 2002 IEEE Int. Geosci. Remote Sensing Symp. and 24th Canadian Symp. Remote Sensing*, Toronto, Canada.
- d. Strong, A. E., C. B. Barrientos, C. Duda, and J. Sapper, 1997. Improved satellite techniques for monitoring coral reef bleaching. *Proc 8th International Coral Reef Symposium*, Panama City, Panama, p 1495-1498.
- f. Gleeson, M. W. and A.E. Strong, 1995. Applying MCSST to coral reef Bleaching. *Adv. Space Res.*, 16(10), 10,151-10,154.